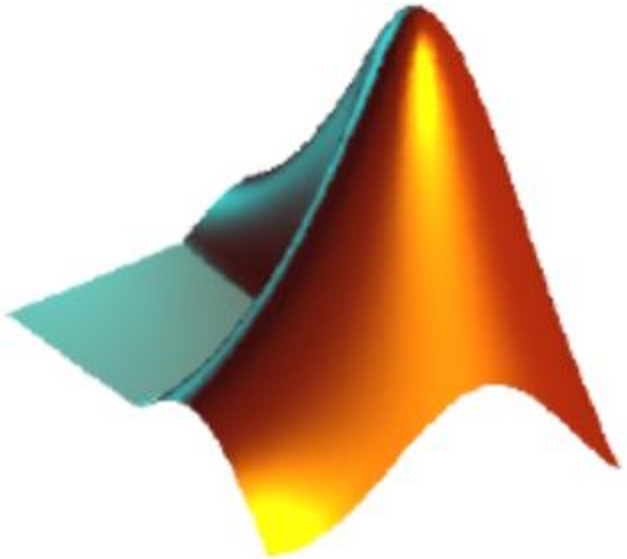
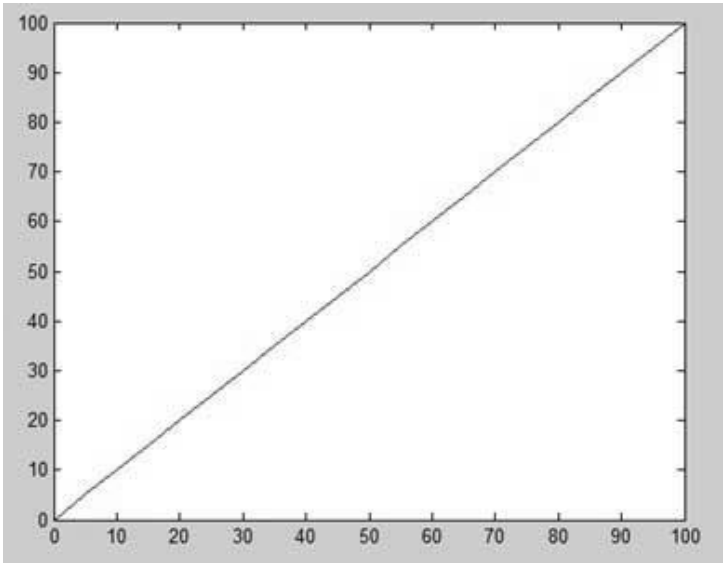
PLOTTING



Plot command

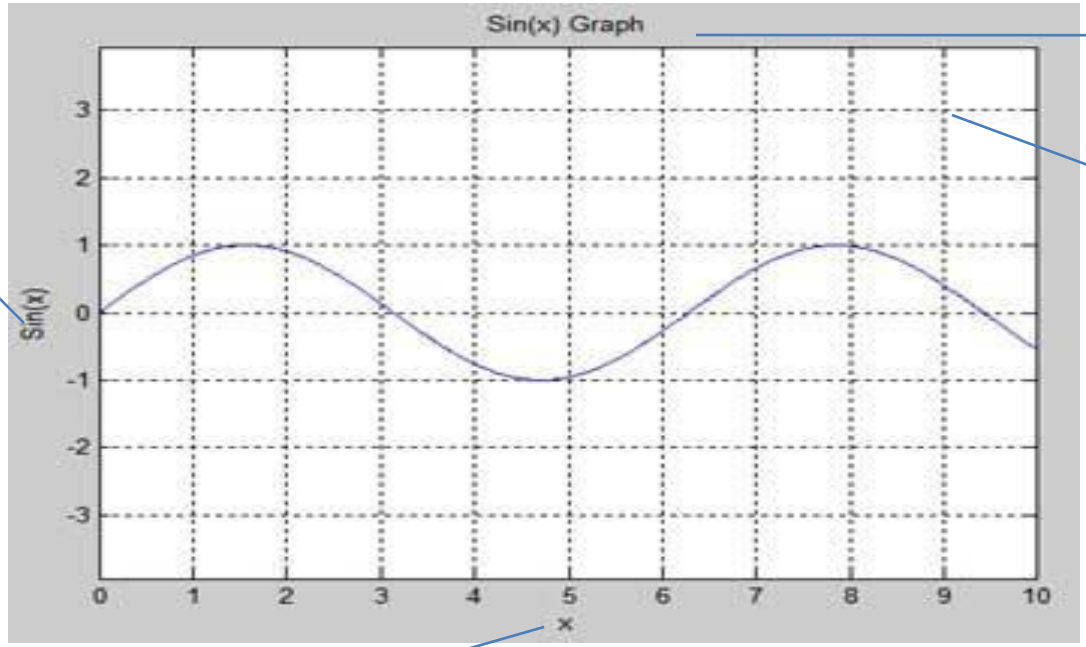
- To plot a graph you have to define:
  - Define **x, for which the function is to be plotted,**
  - Define the function, **y = f(x)**
  - Call the **plot command, as plot(x, y)**
- Example:

```
>>x = [0:5:100];
>>y = x;
>>plot(x, y)
```



Adding Title, Labels, Grid Lines, and Scaling on the Graph

```
>> x = [0:0.01:10];
>>y = sin(x);
>>plot(x, y), xlabel('x'), ylabel('Sin(x)'), title('Sin(x) Graph'), grid on, axis equal
```



Graph title

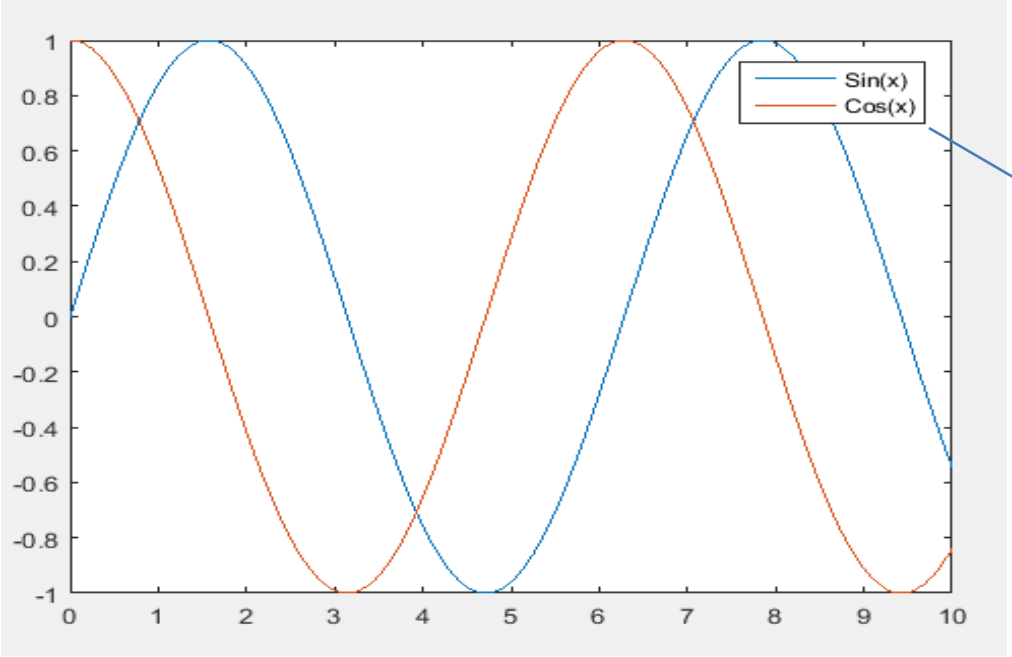
y-axis label

Grid is on

x-axis label

Drawing Multiple Functions on the Same Graph

```
>> x = [0 : 0.01: 10];  y = sin(x);
>> g = cos(x);
>>plot(x, y, x, g, '.-'), legend('Sin(x)', 'Cos(x)')
```



legend

Setting Colors on Graph

- **plot(x,y,'color_line style_marker')**

String containing **from 1 to 4 characters enclosed in single quotes**

Symbol	Color	Symbol	Line Style	Symbol	Marker
k	Black	–	Solid	+	Plus sign
r	Red	– –	Dashed	o	Circle
b	Blue	:	Dotted	*	Asterisk
g	Green	–.	Dash-dot	.	Point
c	Cyan	none	No line	×	Cross
m	Magenta			s	Square
y	Yellow			d	Diamond

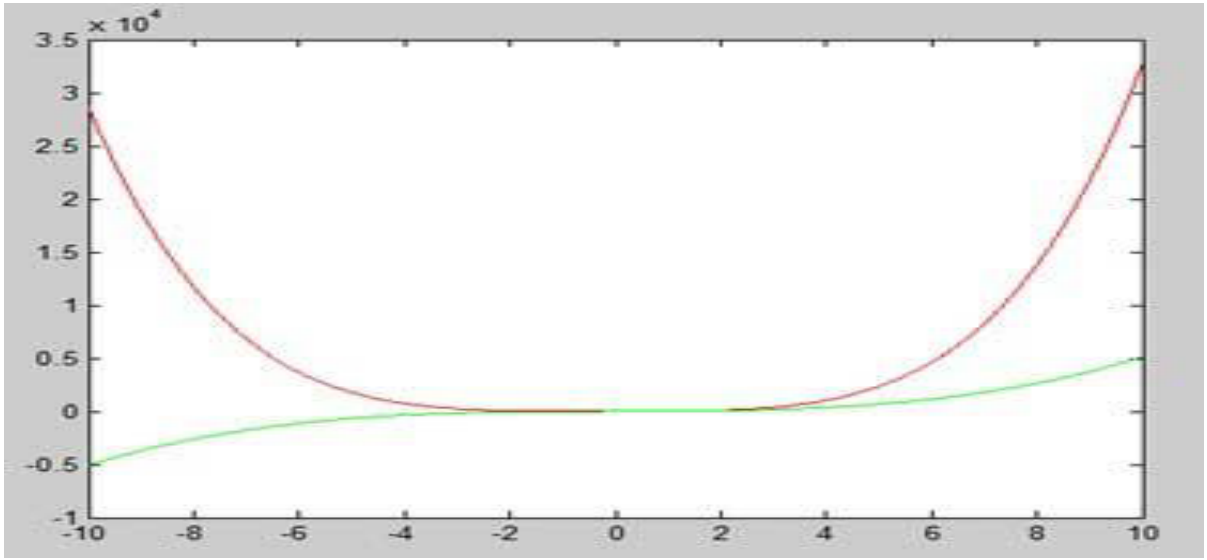
Setting Colors on Graph Example

Let us draw the graph of two polynomials

f(x) = 3x4 + 2x3+ 7x2 + 2x + 9 and

g(x) = 5x3 + 9x + 2

```
>> x = [-10 : 0.01: 10];
>>y = 3*x.^4 + 2 * x.^3 + 7 * x.^2 + 2 * x + 9;
>>g = 5 * x.^3 + 9 * x + 2;
>>plot(x, y, 'r', x, g, 'g')
```

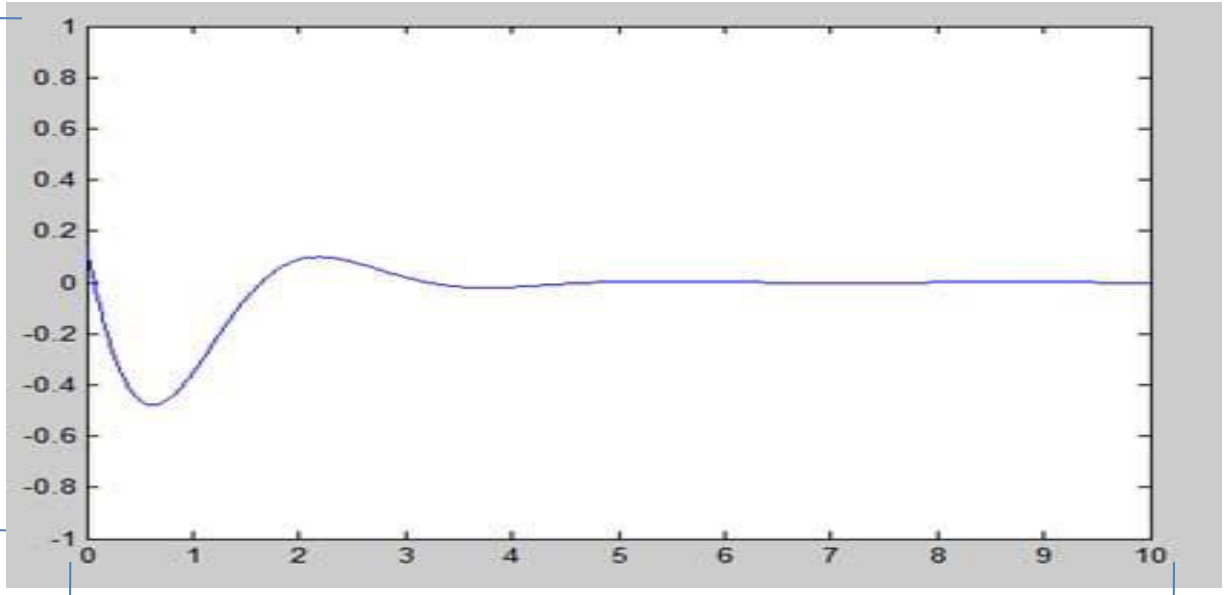


Setting Axis Scales

- axis ([xmin xmax ymin ymax])

```
>> x = [0 : 0.01: 10];
>>y = exp(-x).* sin(2*x + 3);
>>plot(x, y), axis([0 10 -1 1])
```

y-axis from -1 to 1

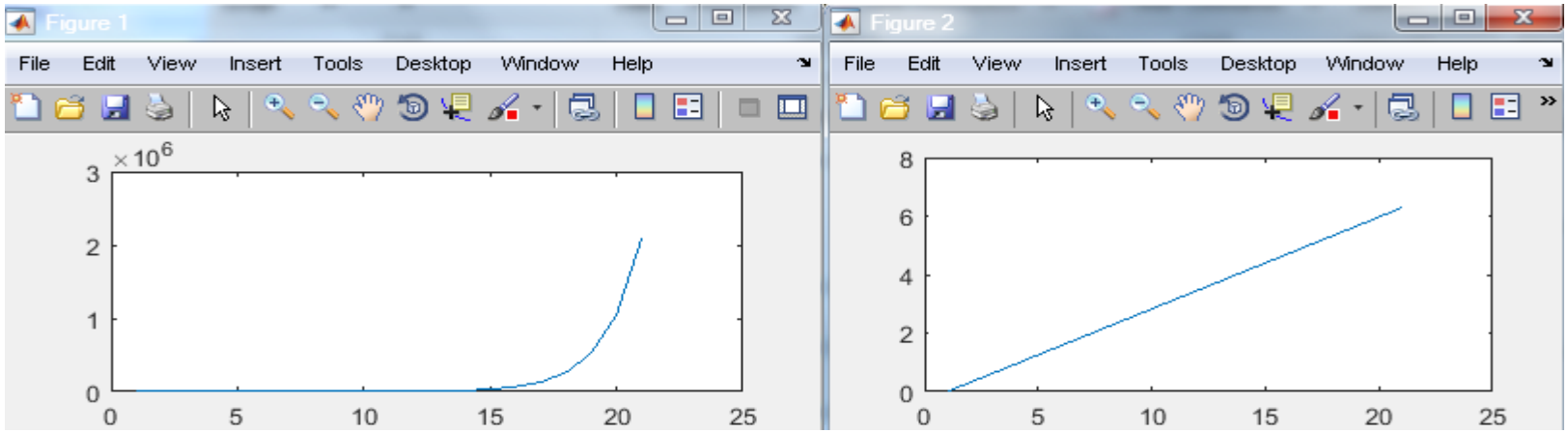


x-axis from 1 to 10

Giving an extra figure

- **Note**: each graph is plotted on a single figure such that the previous one is disappeared.
- To preserve the previous graph, figure command is used.

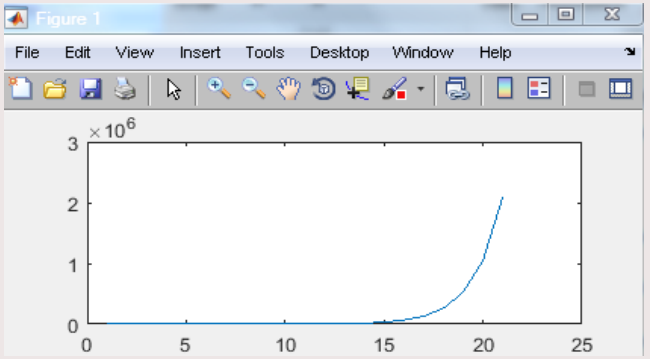
```
>> x = 1:21;
>> y = 2.^x;
>> plot(x,y)
>> x2 = 0:pi/10:2*pi;
>> figure; plot(x, x2)
```



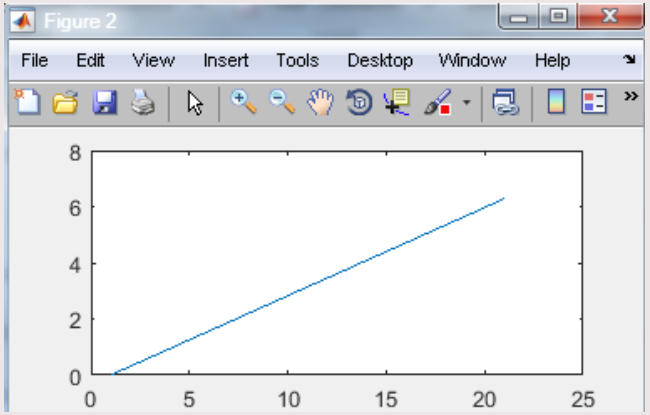
Switching between Figures

- To switch between figures the command **figure(n)** is used where n is the figure number

>>Figure(1);



>>Figure(2);



Generating Sub-Plots

- Subplot(m, n, p) ;

#of rows,

# of columns,

the place of the graph

Example:

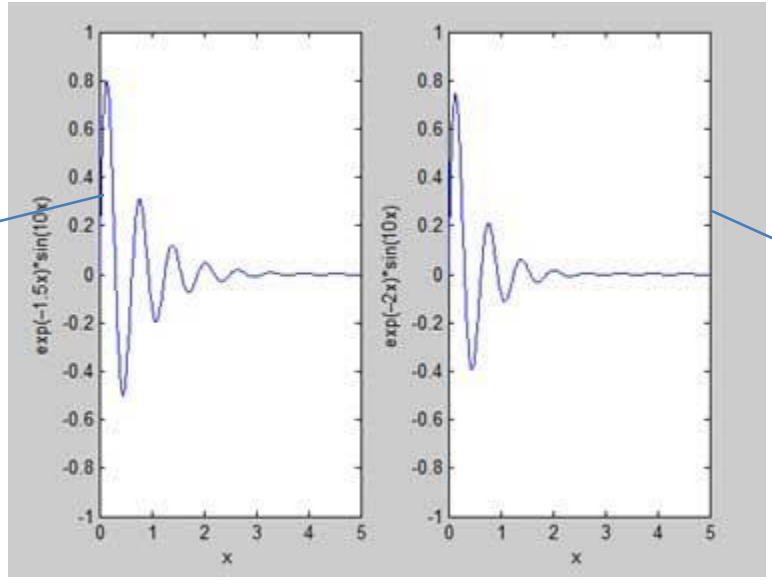
- Let us generate two plots:

  y = e−1.5xsin(10x)

  y = e−2xsin(10x)

Generating Sub-Plots: Example

```
>>x = [0:0.01:5];
>>y = exp(-1.5*x).*sin(10*x);
>>subplot(1,2,1)
>>plot(x,y), xlabel('x'),ylabel('exp(–1.5x)*sin(10x)'),axis([0 5 -1 1])
>>y = exp(-2*x).*sin(10*x);
>>subplot(1,2,2)
>>plot(x,y),xlabel('x'),ylabel('exp(–2x)*sin(10x)'),axis([0 5 -1 1])
```



Subplot(1, 2, 1)

Subplot(1, 2, 2)

Saving graphs

- To save the current figure from the command line

```
>> saveas(q ,'c:\sin figure')
```

- To load the saved figure file from the command line

```
>> open('c:\sin figure.fig')
```

- To clear figure and reset its properties to the default values

```
>> clf reset
```

- To turns the grid lines on, type:

```
>> grid on
```

- To turns the grid lines off, type:

```
>> grid off
```

Graphics: Drawing Bar Charts

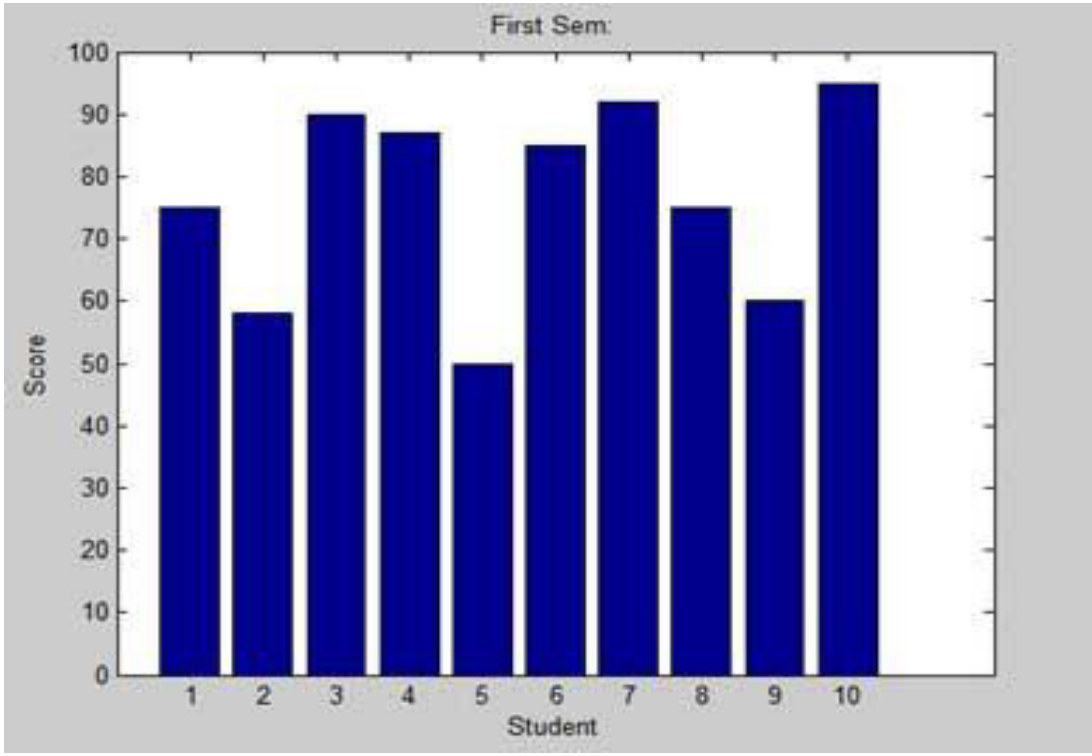
- bar command: draw a 2-D bar chart

Example

- Let us have an imaginary classroom with 10 students.
- We know the percent of marks obtained by these students are 75, 58, 90, 87, 50, 85, 92, 75, 60 and 95.
- We will draw the bar chart for this data.

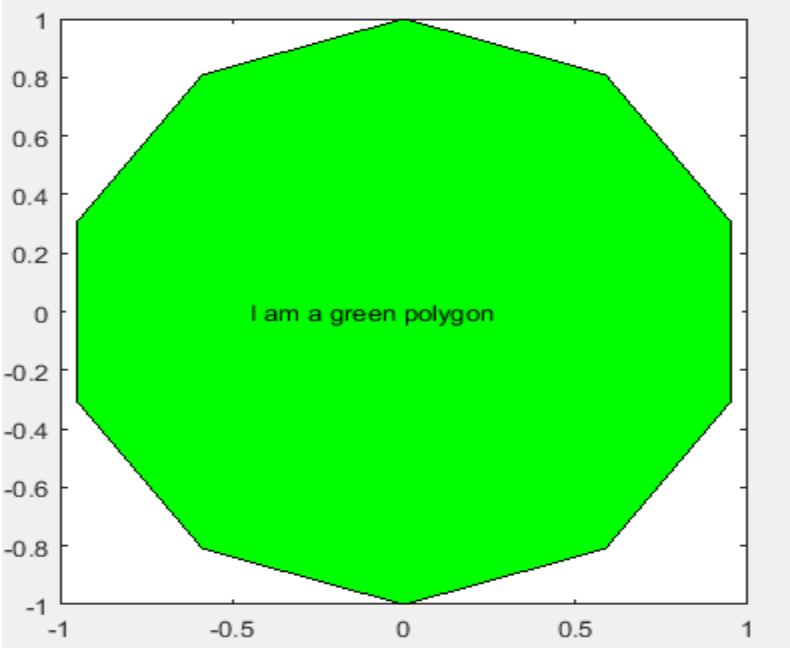
Graphics: Drawing Bar Charts Example

```
>>x = [1:10];
>>y = [75, 58, 90, 87, 50, 85, 92, 75, 60, 95];
>>bar(x,y), xlabel('Student'),ylabel('Score'), title('First Sem:')
```



Graphics: filling Charts

```
>> N = 5; k = -N:N;
>> x = sin(k*pi/N);
>> y = cos(k*pi/N);        % x and y - vertices of the polygon to be filled
>> fill(x,y,'g')
>> axis square
>> text(-0.45,0, 'I am a green polygon')
```



Three-Dimensional Plots

3-D plots basically display a surface defined by a function in two variables, g = f (x,y).

HOW??

1- Create a set of (x,y) points over the domain of the function using the meshgrid command.

2- Assign the function itself.

3- Use the surf/mesh command to create a surface plot.

meshgrid command

- **meshgrid command**: generate a matrix of elements that give the range over x and y along with the specification of increment in each case.

Example:

- g = f(x, y), where −5 ≤ x ≤ 5, −3 ≤ y ≤ 3.
- Let us take an increment of 0.1 for both the values.
- The variables are set as:

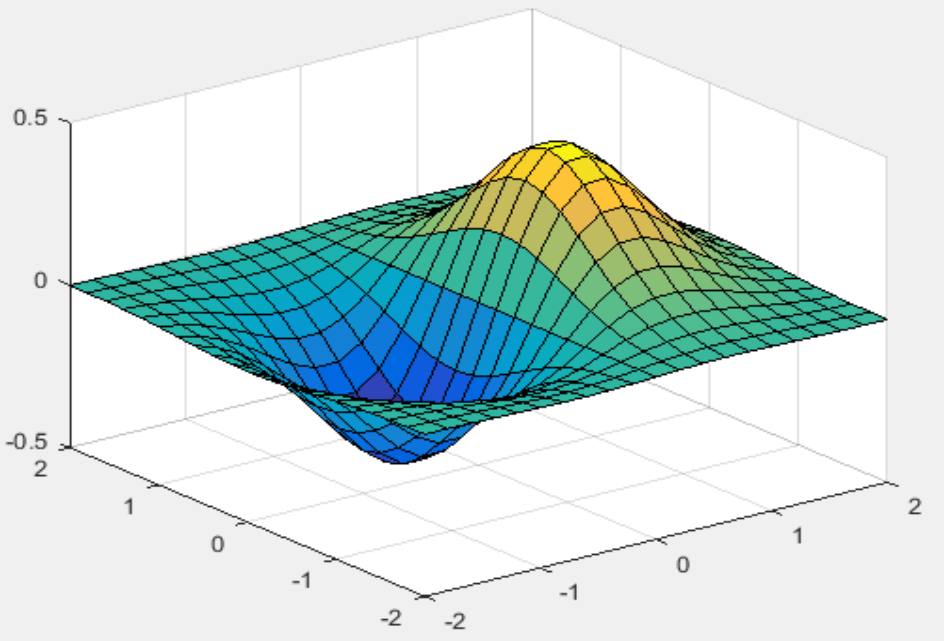
>>[x,y] = meshgrid(–5:0.1:5, –3:0.1:3);

Three-Dimensional Plots Example (surf)

Let us create a 3D surface map for the function $g = x\, e^{-(x2 + y2)}$

```
>>[x,y] = meshgrid(-2:.2:2);      % 1st step
>>g = x .* exp(-x.^2 - y.^2);     %2nd step
>>surf(x, y, g)                   %3rd step
```

surf command: displays both the connecting lines and the faces of the surface in color.



Three-Dimensional Plots Example (mesh)

Let us create a 3D surface map for the function $g = x\, e^{-(x2 + y2)}$

```
>>[x,y] = meshgrid(-2:.2:2);      % 1st step
>>g = x .* exp(-x.^2 - y.^2);     %2nd step
>>mesh(x, y, g)                   %3rd step
```

mesh command: creates a wireframe surface with colored lines connecting the defining points.